

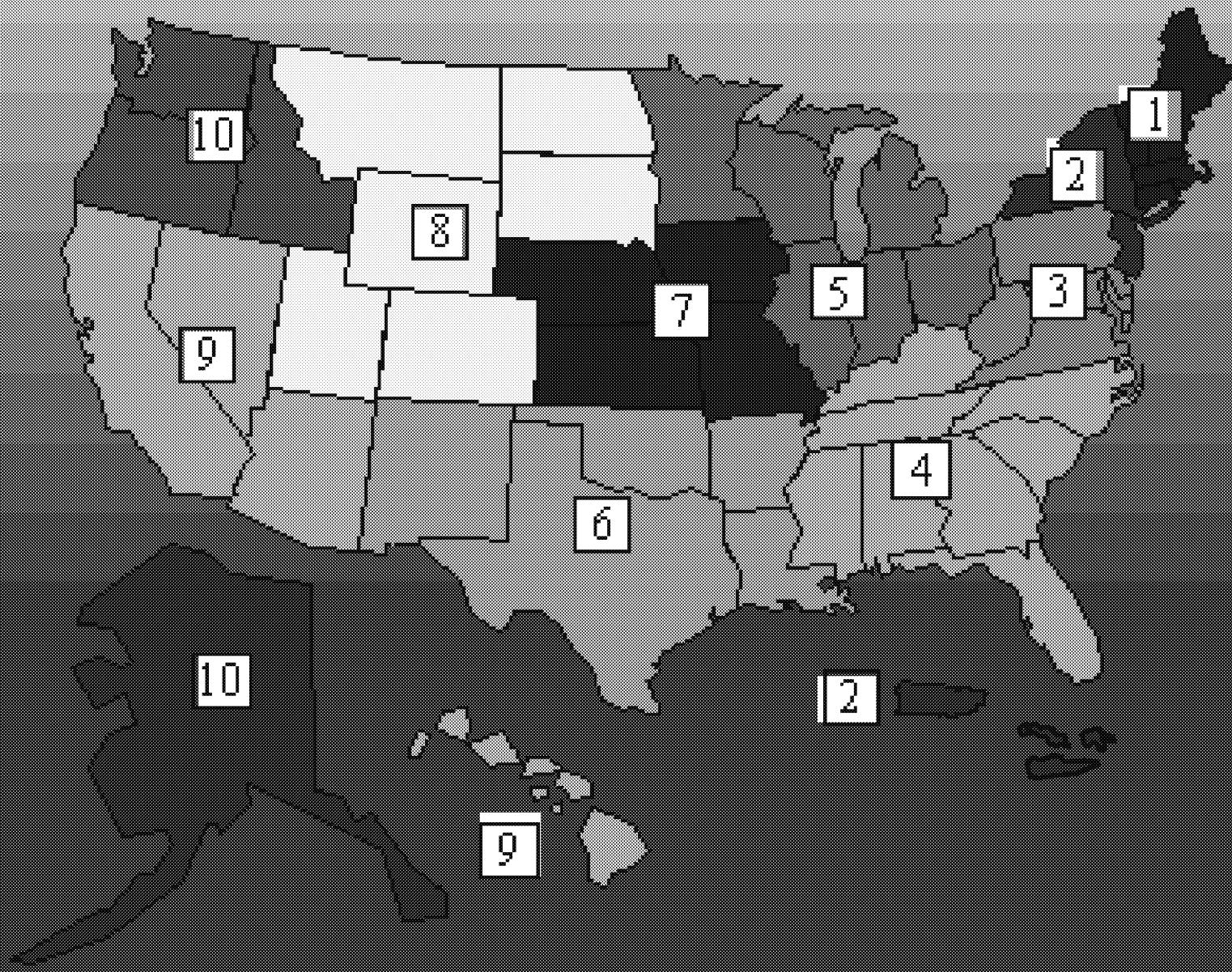
738 Upper Mountain Road Removal Site

Eric Daly, On-Scene Coordinator
USEPA Region 02

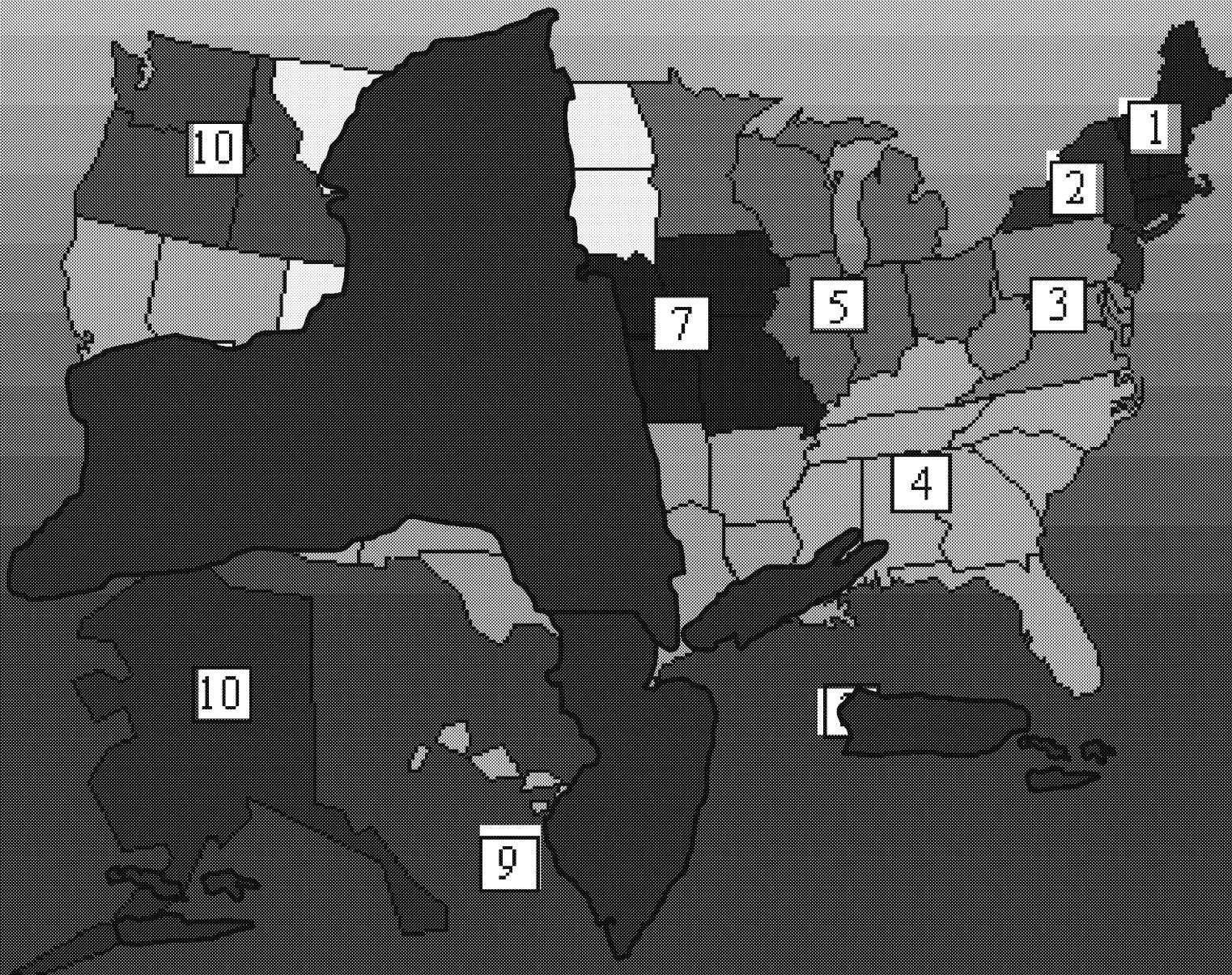
Lyndsey Nguyen, Health Physicist
USEPA Environmental Response Team—West

October 21, 2019

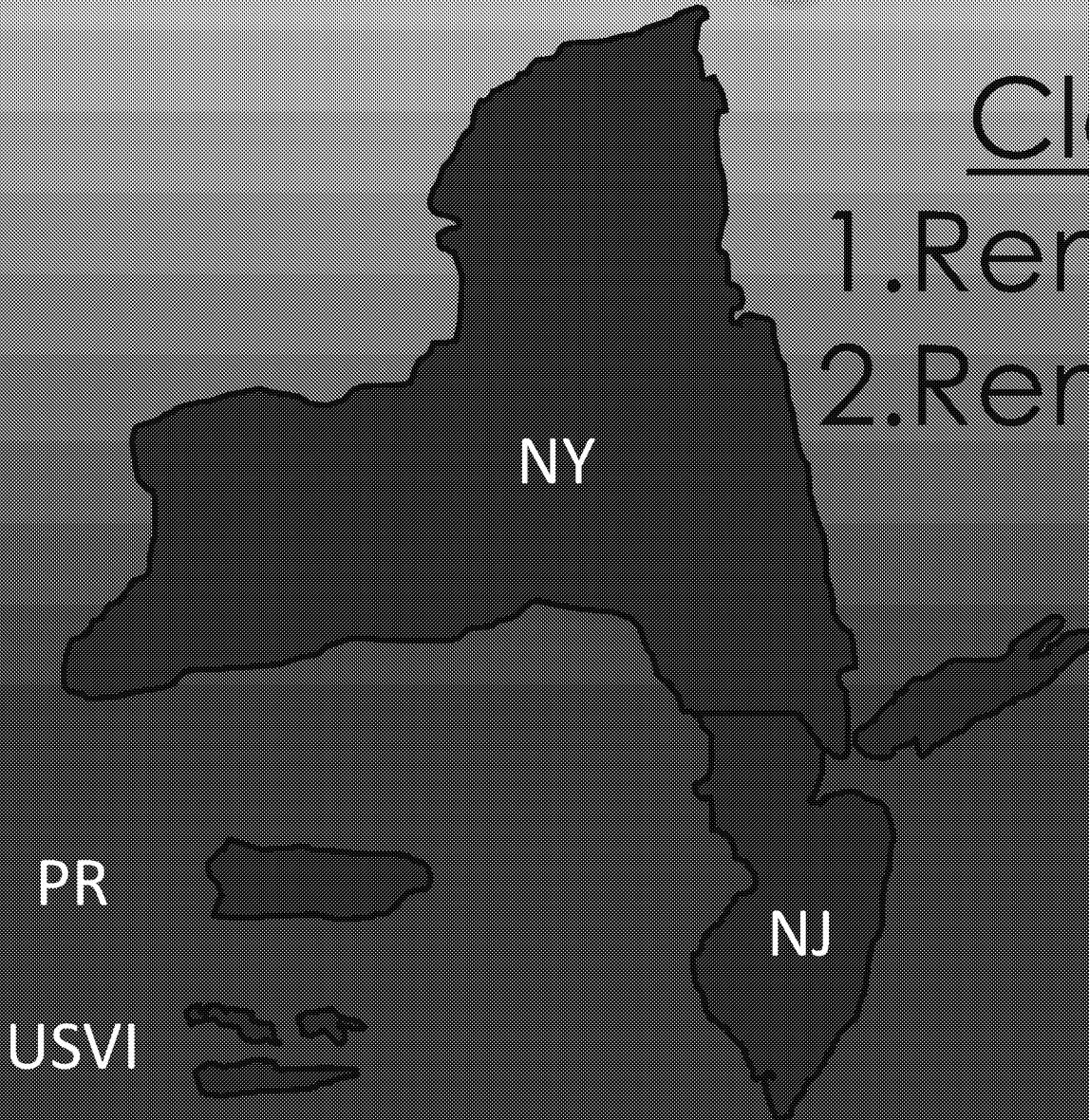
Who we are?



Who we are?



Region 2



Clean up:

1. Removal—OSC
2. Remedial—RPM

Special Teams



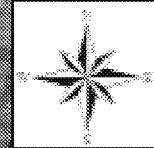
Environmental Response Team (ERT)

★ Consequence Management Advisory Team (CMAT)

Radiological Emergency Response Team (RERT)

★ National (NCERT)

Site: 738 UMR



History

- In July 1985, members of the Radiological Survey Activities (RASA) Group at Oak Ridge National Laboratory (ORNL) performed a radiological survey of the Site for the U.S. Department of Energy (DOE), which documented a maximum gamma exposure rate of 710 microroentgens per hour ($\mu\text{R}/\text{hr}$). Biased surface soil samples collected during the survey indicated the presence of Radium-226 (Uranium-238, and Thorium-232) at the Site.
 - ⊗ In general, background gamma is roughly 10-20 $\mu\text{R}/\text{hr}$
 - ⊗ Roughly about 50 times background
 - ⊗ Rule of thumb: EPA starts investigating at roughly 3 times background
- During a reconnaissance performed by the New York State Department of Health (NYSDOH) and the New York State Department of Conservation (NYSDEC) on July 9, 2013, screening activities showed radiation levels at 300 $\mu\text{R}/\text{hr}$ with a hand-held pressurized ion chamber. The background readings for this Site were approximately 10 $\mu\text{R}/\text{hr}$.
 - ⊗ Readings from the State were 30 times background

Contaminant: “Slag”

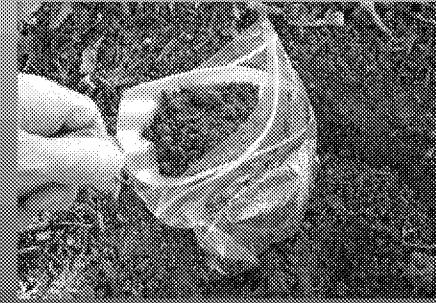
Radioactive Rock or “Slag” was used as fill dirt for roadways and parking lots throughout the Niagara Falls region



Units: So Confusing!

S
o
i
-

- pCi/g--true value of contamination in soil



E
m
i
+

- cpm--estimating how much contamination from a detector
- $\mu\text{R}/\text{hr}$ --estimating the amount of radiation in air (exposure)
- mrem/hr --estimating how much radiation the body receives (dose)

Units: So Confusing!

- pCi/g

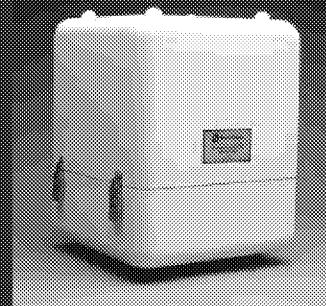
Quantitative
Measurements

- cpm

- $\mu\text{R}/\text{hr}$

Qualitative
Measurements

- mrem/hr



Static Measurement
Ex. Scalar Mode



Scan Measurement
Ex. Rate mode

Units: So Confusing!

- pCi/g

Quantitative
Measurements

- cpm

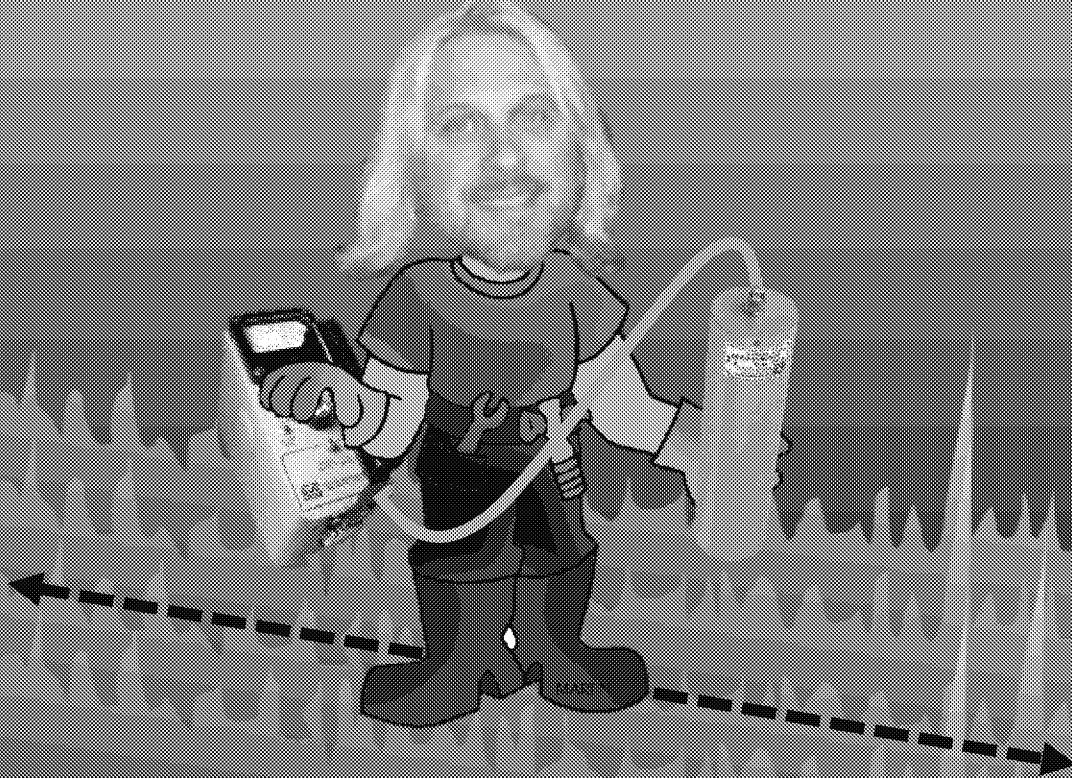
Qualitative
Measurements

- μ R/hr

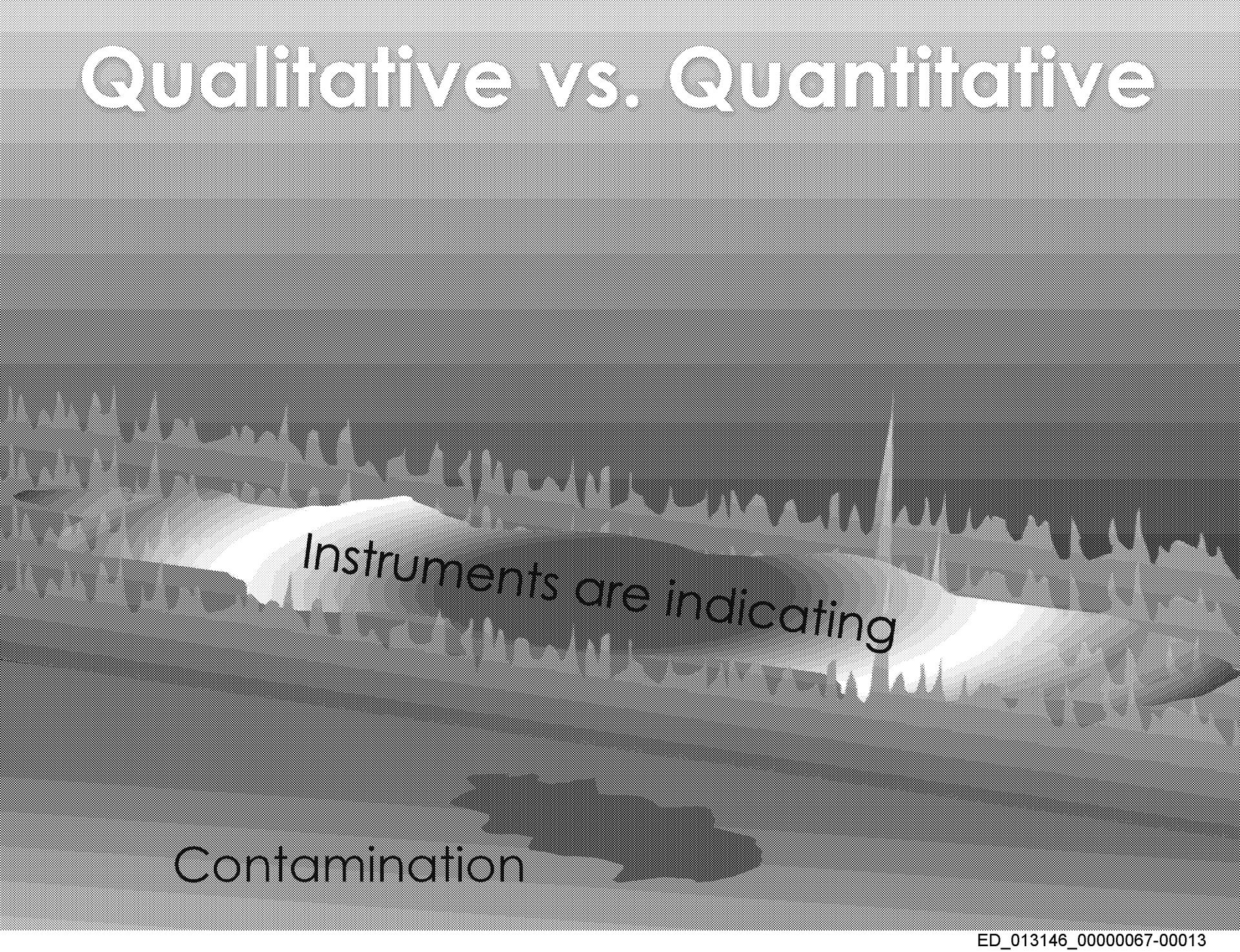
- mrem/hr

Base the removal eligibility off
of Quantitative Data

Qualitative vs. Quantitative



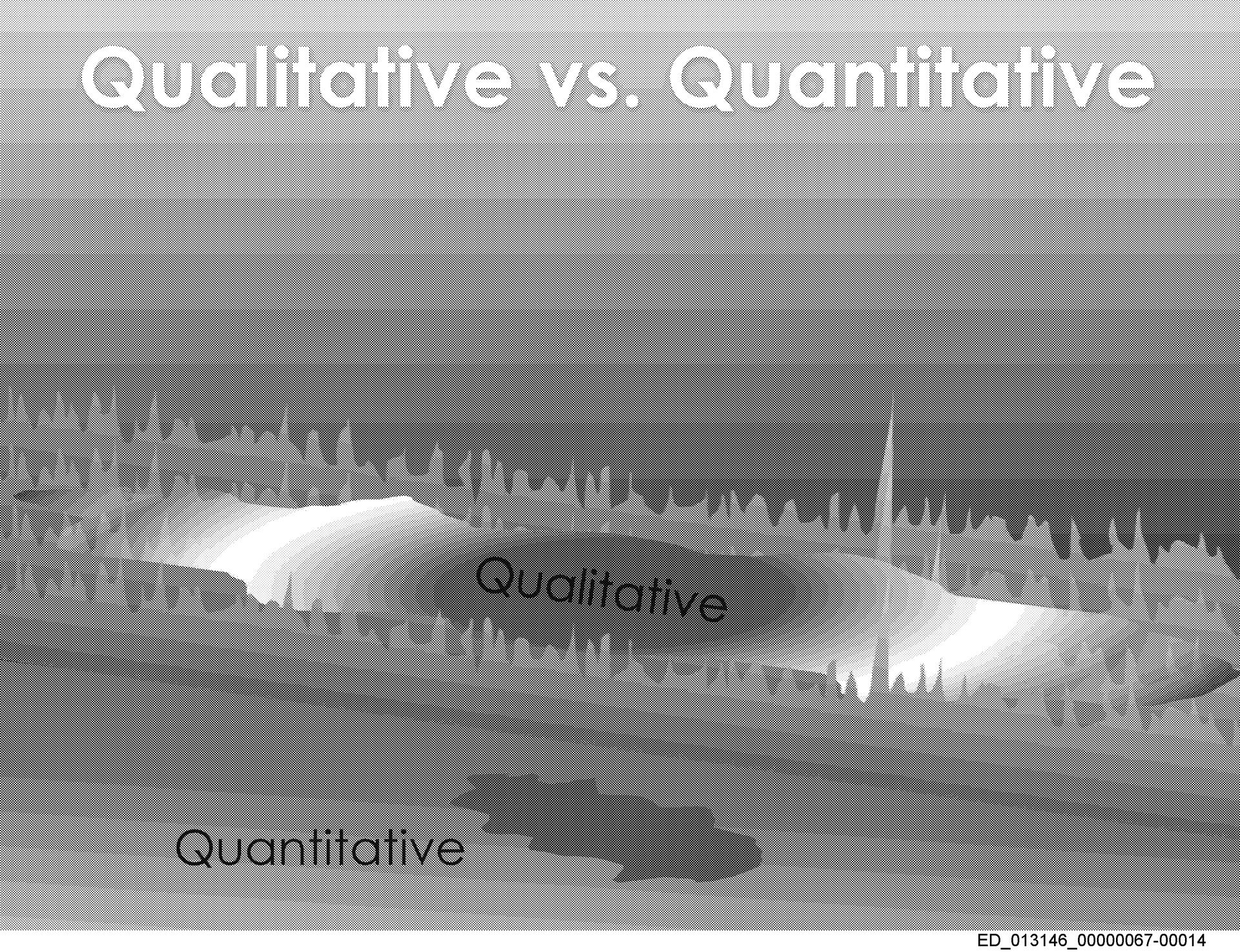
Qualitative vs. Quantitative



Instruments are indicating

Contamination

Qualitative vs. Quantitative

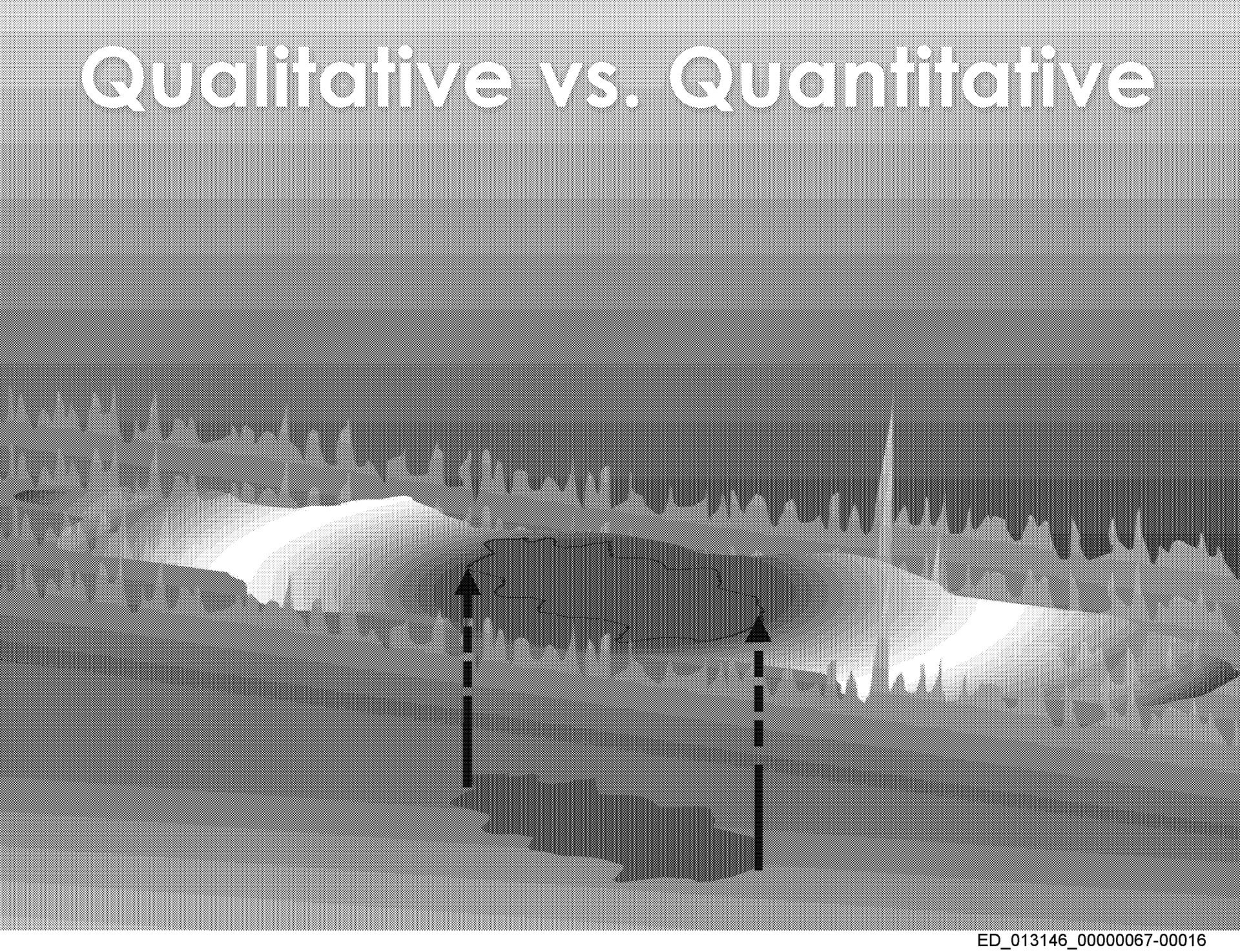


Qualitative

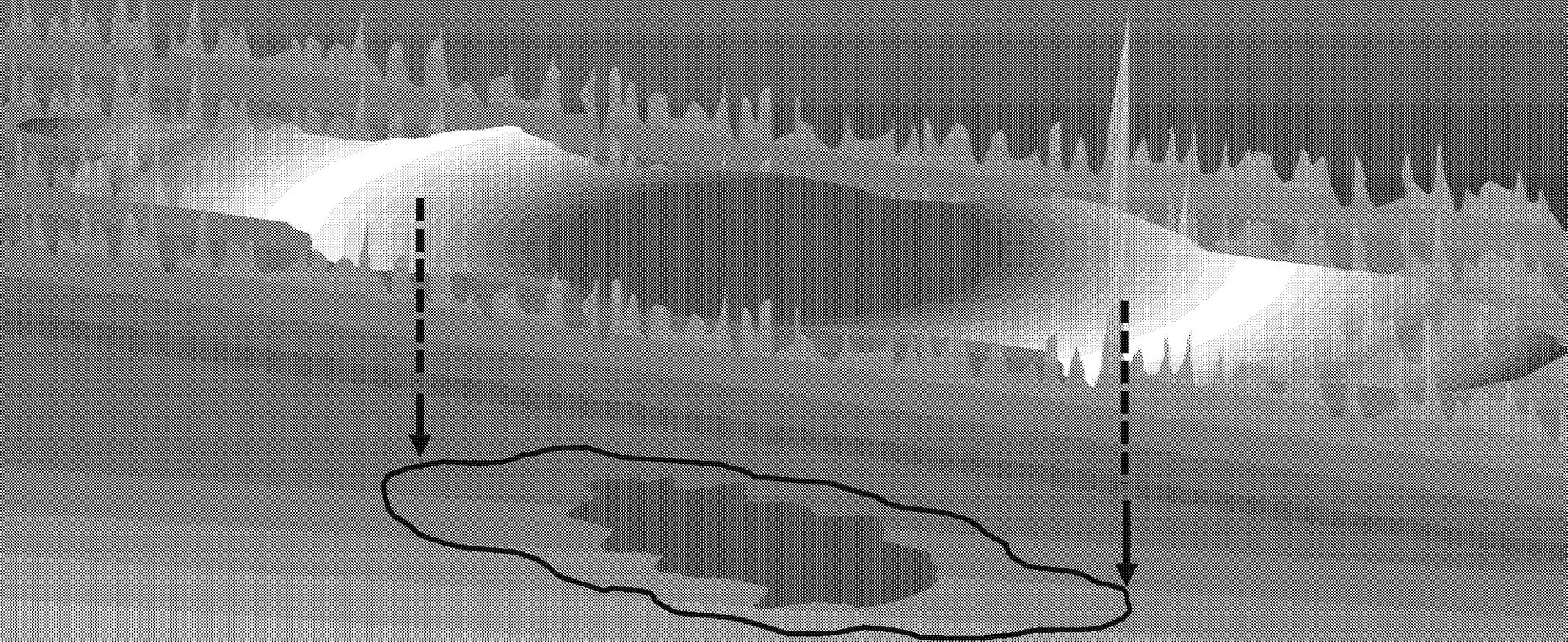
Quantitative

Qualitative vs. Quantitative

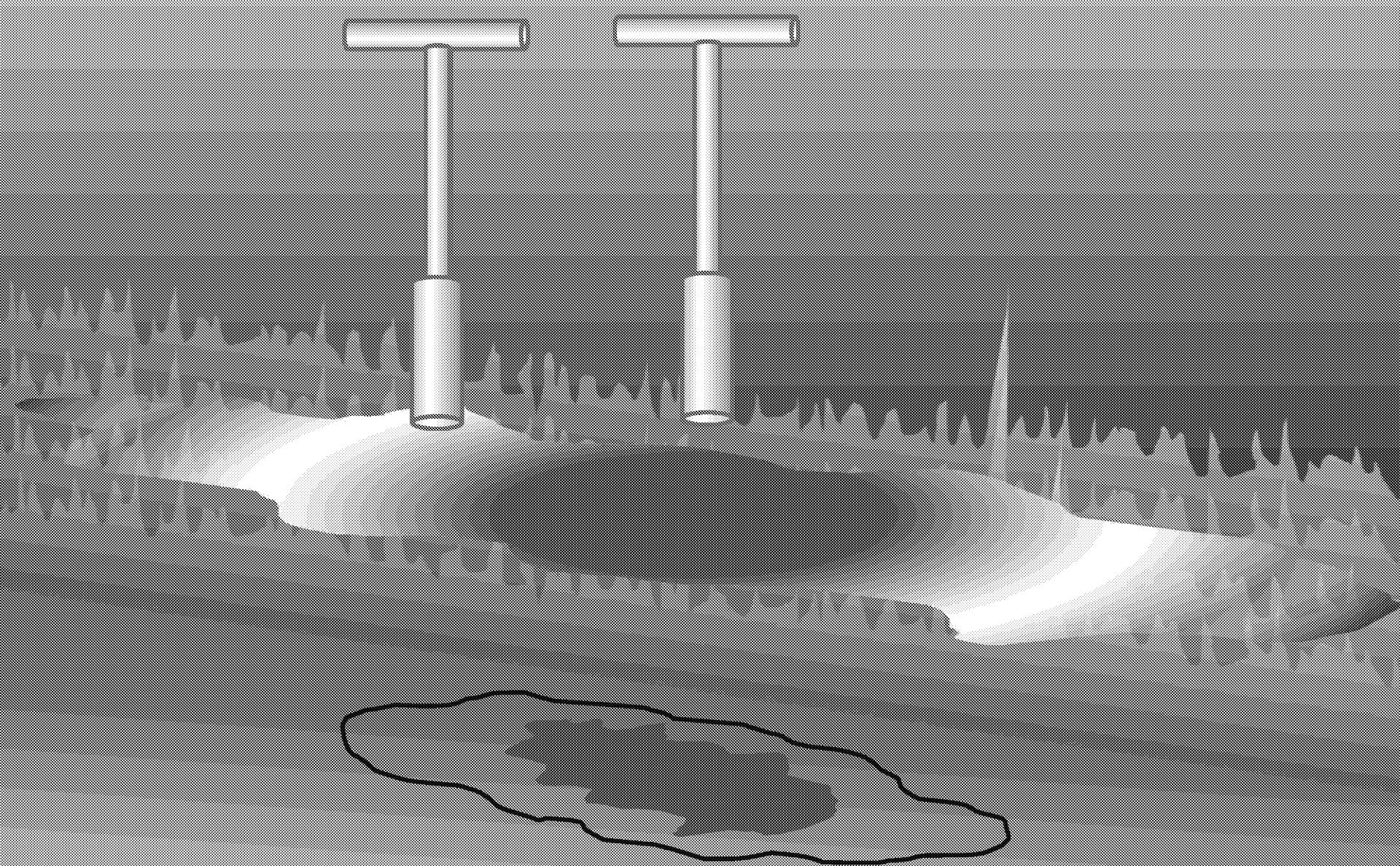
Qualitative vs. Quantitative



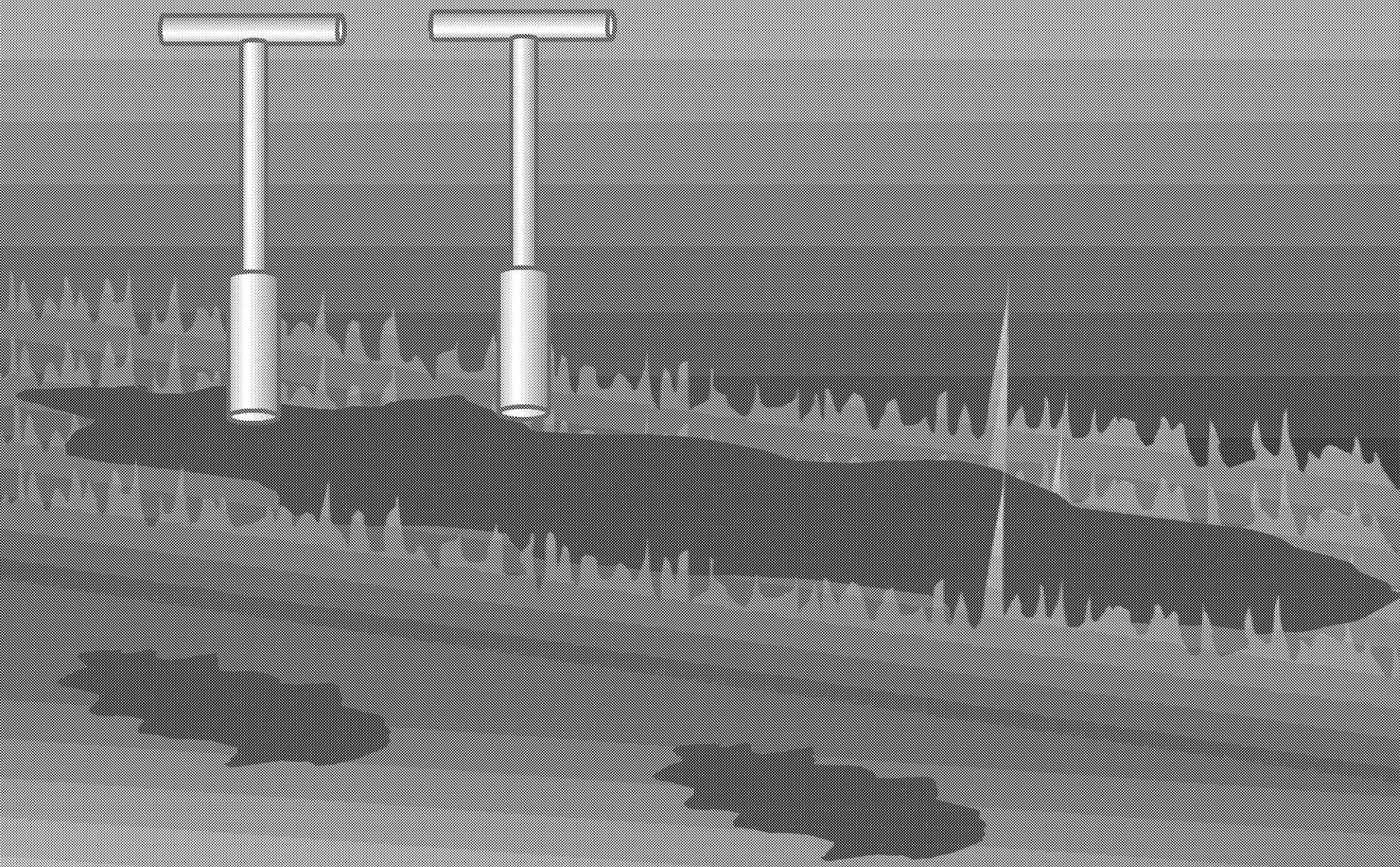
Qualitative vs. Quantitative



Qualitative vs. Quantitative



Qualitative vs. Quantitative



EPA Site Assessment

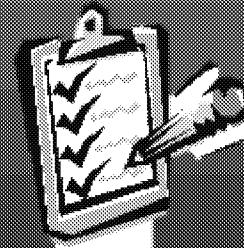
- The NYSDEC and NYSDOH referred the Site to EPA on July 21, 2013 for further assessment.
- From September 2013 through May 2014, the EPA Region 2 Pre-Remedial Section (PRS) initiated a preliminary assessment (PA) and site inspection (SI) to assess whether the Site posed a threat to human health and the environment.

How does it work?

Immediate Threat?
Emergency aspects?
Removal

Remedial

Pre-Remedial



Meet the
National Priority List?

No
Removal

Yes
Remedial

EPA Site Assessment

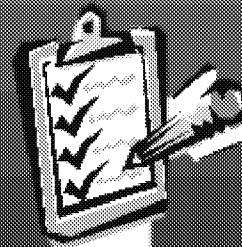
- ✿ Based on the PA and SI results, a Hazardous Ranking System (HRS) score was calculated. The calculated HRS score for the Site was less than 28.5 and, as a result, the Site did not qualify for inclusion on the NPL. In May 2015, the Site was referred to the Emergency and Remedial Response Division, now the Superfund and Emergency Management Division (SEMD), Removal Action Branch (RAB) for a determination as to whether the Site warranted a CERCLA removal action.
- ✿ Initially, 738 Upper Mountain Road was deemed ineligible for a removal action based on information at the time. However, after EPA OSC and ERT Health Physicist assessed the three other radiological site, the same assessment criteria was applied to 738 UMR Site.

738 UMR

Immediate Threat?
Emergency aspects?
Removal

Remedial

Pre-Remedial
Meet the
National Priority List?



Removal

No → Yes

Remedial

Region 2



Clean up:
1. Removal-OSC
2. Remedial-RPM

Pre-Remedial Data:

2005 11-2-5 Sheet		
Uranium-238	38.7	pCi/g
Thorium-232	21.2	pCi/g
Uranium-232/234	27.0	pCi/g
Potassium-40	32.8	pCi/g
Thorium-232	11.8	pCi/g
Radon-222	105	pCi/g
Thorium-232	11.8	pCi/g
Uranium-238/232	1.46	pCi/g

2005 11-2-5 Sheet		
Uranium-238	8.88	pCi/g
Thorium-232	4.74	pCi/g
Uranium-232/234	8.87	pCi/g
Potassium-40	18.7	pCi/g
Thorium-232	23.6	pCi/g
Radon-222	88.5	pCi/g
Thorium-232	19.1	pCi/g
Uranium-238/232	0.036	pCi/g

2005 11-2-5 Sheet		
Uranium-238	0.01	pCi/g
Thorium-232	0.005	pCi/g
Uranium-232/234	0.007	pCi/g
Potassium-40	1.27	pCi/g
Thorium-232	1.38	pCi/g
Radon-222	2.31	pCi/g
Thorium-232	1.65	pCi/g
Uranium-238/232	0.0003	pCi/g

2005 11-2-5 Sheet		
Uranium-238	0.004	pCi/g
Thorium-232	0.005	pCi/g
Uranium-232/234	0.002	pCi/g
Potassium-40	1.22	pCi/g
Thorium-232	1.26	pCi/g
Radon-222	4.23	pCi/g
Thorium-232	2.42	pCi/g
Uranium-238/232	0.0001	pCi/g

2005 11-2-5 Sheet		
Uranium-238	1.40	pCi/g
Thorium-232	1.80	pCi/g
Uranium-232/234	1.30	pCi/g
Potassium-40	2.22	pCi/g
Thorium-232	8.31	pCi/g
Radon-222	7.08	pCi/g
Thorium-232	4.54	pCi/g
Uranium-238/232	0.0004	pCi/g

2005 11-2-5 Sheet		
Uranium-238	0.079	pCi/g
Thorium-232	0.039	pCi/g
Uranium-232/234	0.048	pCi/g
Potassium-40	1.21	pCi/g
Thorium-232	0.37	pCi/g
Radon-222	0.92	pCi/g
Thorium-232	0.06	pCi/g
Uranium-238/232	0.0002	pCi/g

2005 11-2-5 Sheet		
Uranium-238	0.002	pCi/g
Thorium-232	0.001	pCi/g
Uranium-232/234	0.002	pCi/g
Potassium-40	1.24	pCi/g
Thorium-232	0.06	pCi/g
Radon-222	0.98	pCi/g
Thorium-232	0.06	pCi/g
Uranium-238/232	0.00014	pCi/g

Background 2005 11-2-5 Sheet		
Thorium-232	0.10	pCi/g
Thorium-232	0.16	pCi/g
Uranium-232/234	0.02	pCi/g
Radon-222	1.03	pCi/g
Thorium-232	0.12	pCi/g
Radon-222	1.37	pCi/g
Thorium-232	0.31	pCi/g
Uranium-238/232	0.00011	pCi/g

Removal Assessment Process

- ✿ Ground Truthing:
 - ✿ How far does it extend past the property
 - ✿ Depth of contamination
 - ✿ Radon/Thoron measurements
- ✿ Verified the contaminant(s)

Removal Assessment: Specifying Site Boundary

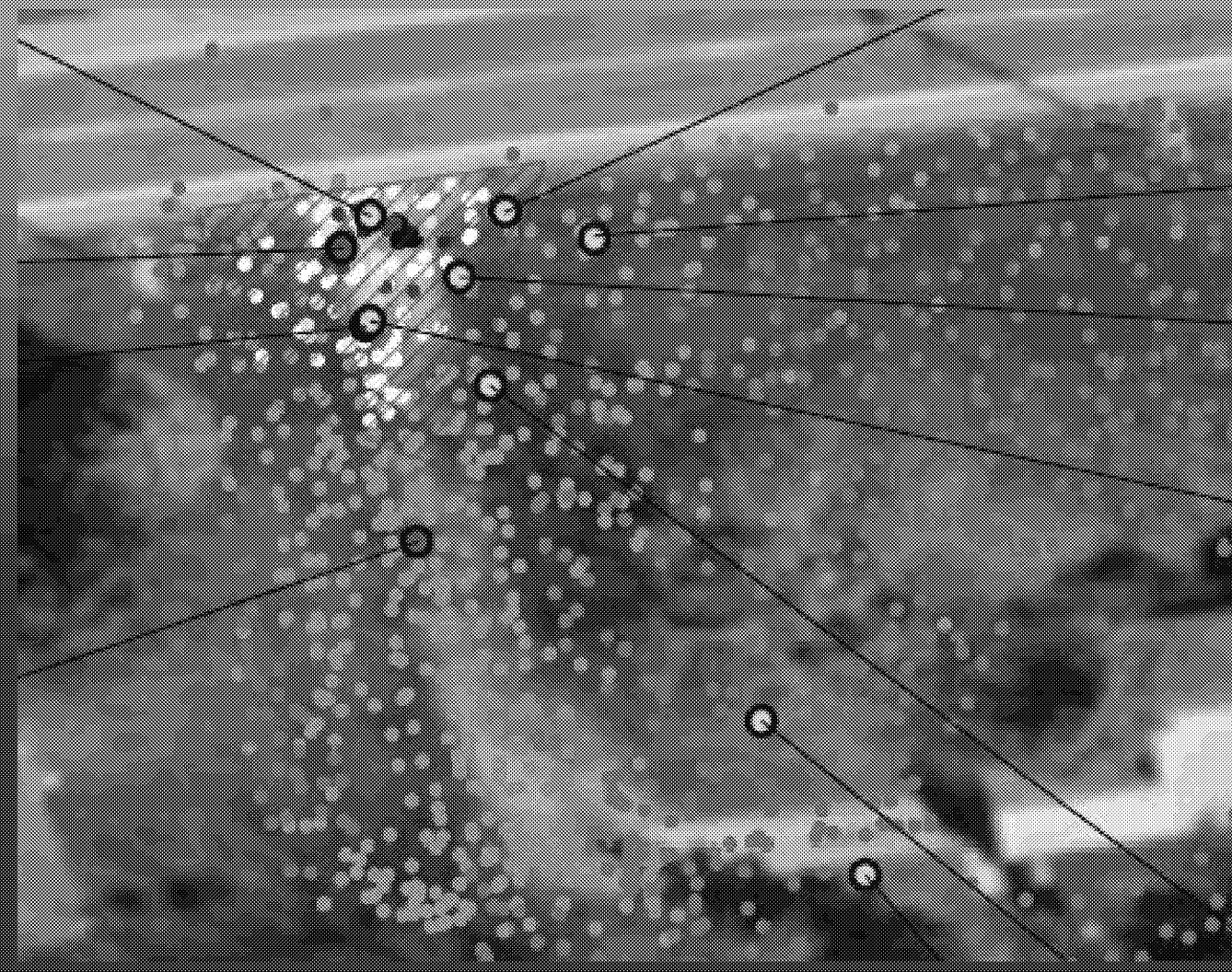


Removal Scan



ED_013146_00000067-00028

Additional Sampling Locations



Contaminant of Concern vs. Highest Values

Radioisotope	Analytical Data
	pCi/g
Actinium-228 (Ac-228)	NA
Bismuth-212 (Bi-212)	244.51
Cesium-137 (Cs-137)	0.489
Lead-212 (Pb-212)	232.95
Potassium-40 (K-40)	29.895
Protactinium-234M	32.995
Radium-226* (Ra-226)	59.575
Radium-228 (Ra-228)	221.46
Thallium-208 (Tl-208)	78.922
Thorium-228 (Th-228)	323.85
Thorium-234 (Th-234)	22.436
Uranium-235 (U-235)	2.401
Thorium-228 (Th-228)	74.7
Thorium-230 (Th-230)	12.2
Thorium-232 (Th-232)	59.1
U-233/234	23.5
U-235/236	1.68
Uranium-238 (U-238)	24.2
Ra-226* (21 days ingrowth)	
Yellow Highlight indicates the highest concentration in the Th-232 decay chain	
Pink Highlight indicates the highest concentration in the U-238 decay chain	

Is this contamination?

- ❖ Three approaches for setting an action limit:
 - Applicable or Relevant and Appropriate Requirements (ARARs)
 - Dose Based Modeling
 - Risk Based Modeling

Our Risk Approach

❖ Internal Risk

- Inhalation—soil (i.e. pCi/g units)
- Ingestion—soil (i.e. pCi/g units)
- Absorption
- Injection

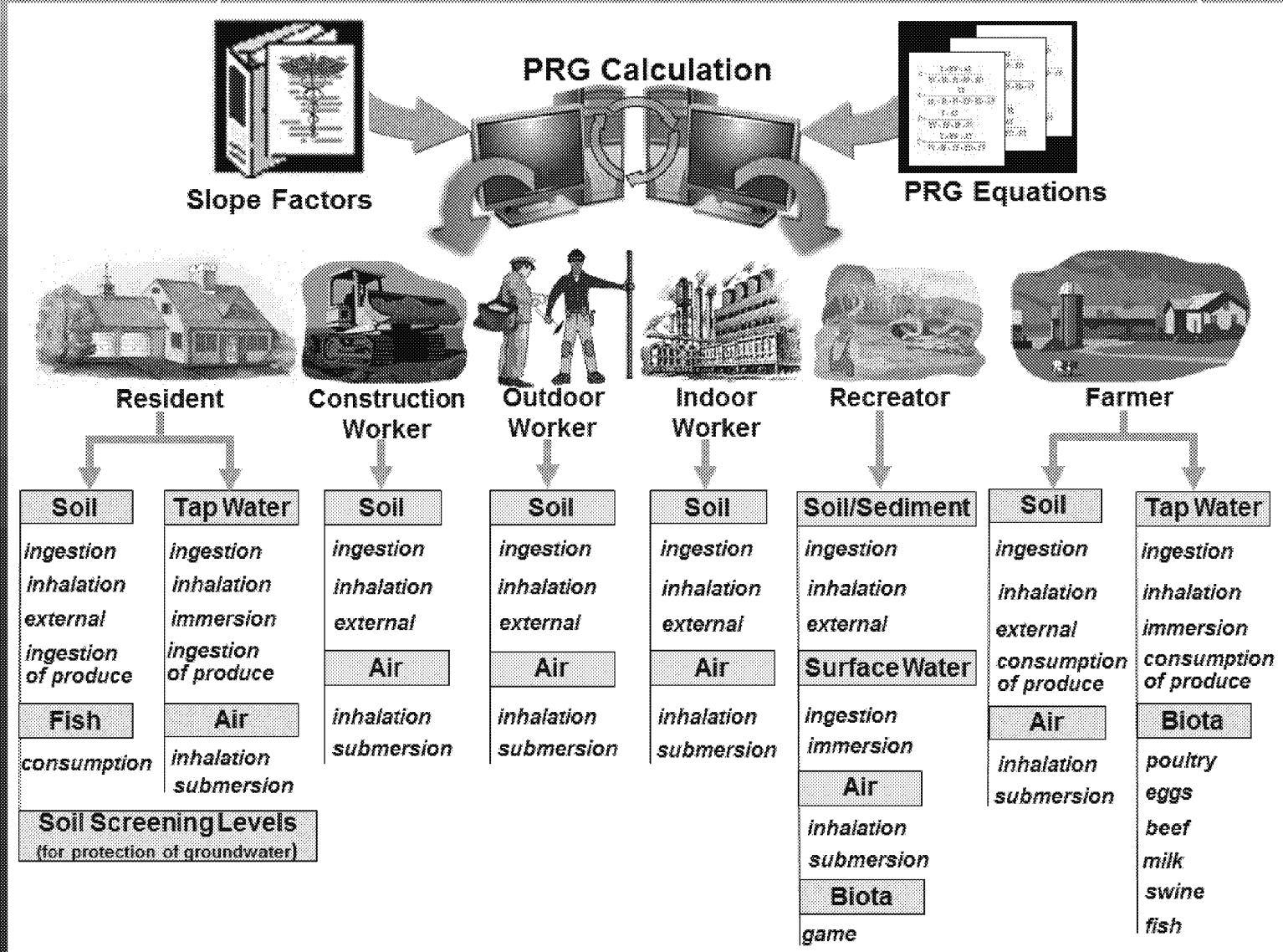
❖ External Risk

- Exposure—gamma (i.e. μ R/hr)
- Dose—gamma (i.e. mrem/hr)

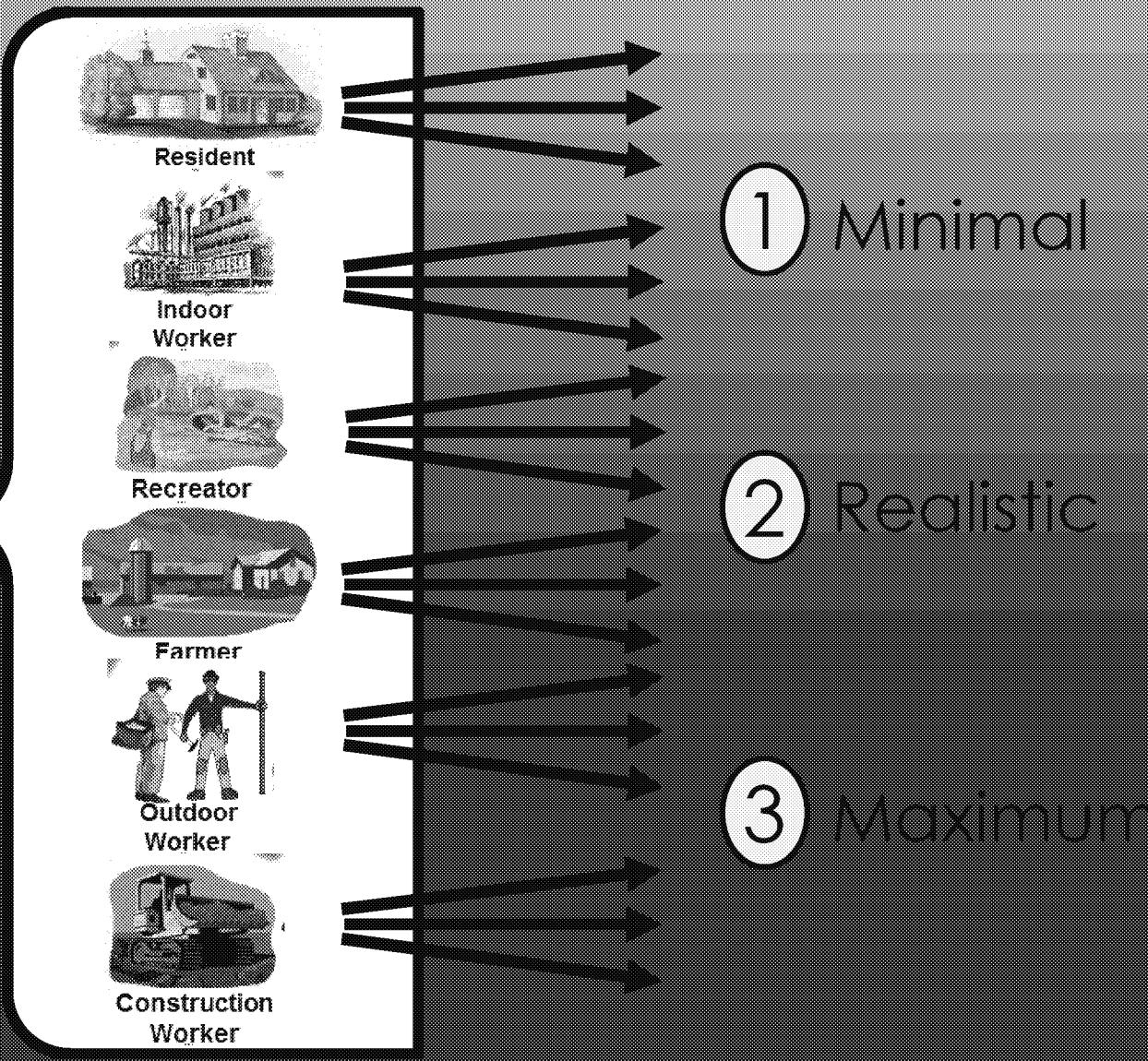
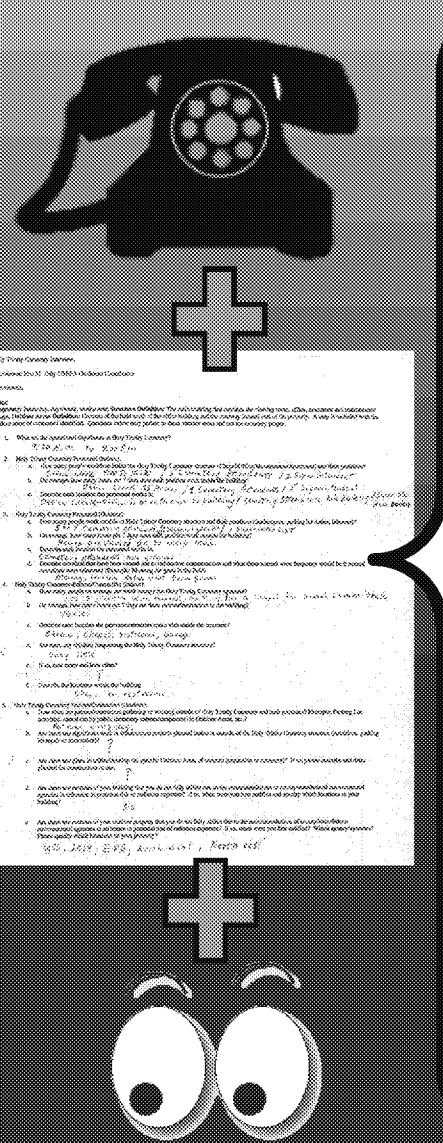
Break?

PRG Overview

Preliminary Remediation Goals for Radionuclides (PRG)



How to choose?



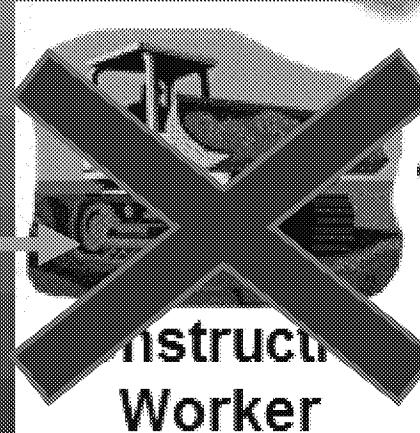
Test out all receptors!

Remember this report is only for one receptor!

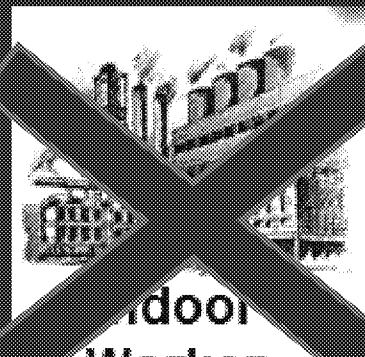


Resident

Which other receptors
are present at your site
with the greatest risk?



**Construction
Worker**



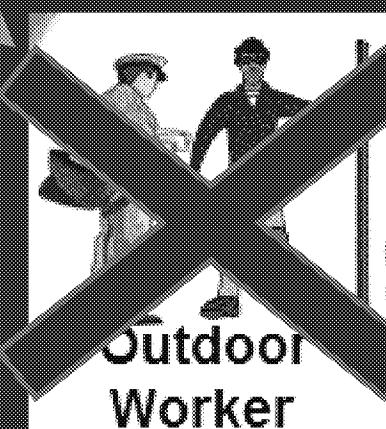
**Indoor
Worker**



Recreator



Farmer

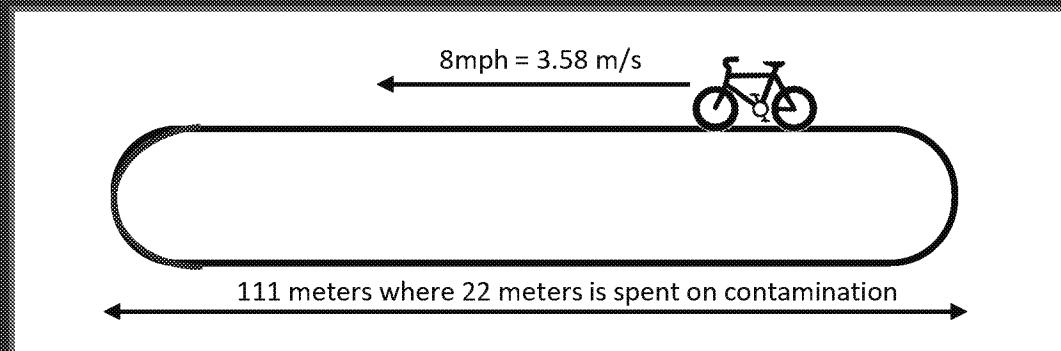


**Outdoor
Worker**

Residential

	Scenarios	mins/day	hours/day	days/year
Child	Child waiting for Bus	30	0.5	180
	Child Playing during School Year (3 hours after school of play)	72	0.6	180
	Child Playing during Summer (5 hours of play)	120	1	120
Adult	Adult Shoveling Snow	60	1	40
	Adult Mowing the Lawn	10	0.417	20
	Adult Landscaping	15	0.625	20
	Adult in Driveway (waiting with child for bus)	30	0.083	365

Child Scenarios of “Play”



Conclusion:

3 hours of play

- 72 mins on top of the contamination

5 hours of play

- 120 mins on top of the contamination

738 UMR Risk Output

Isotope

Ingestion
Risk

Inhalation

External
Exposure
Risk

Produce
Consumption
Risk

Total
Risk

*Secular Equilibrium Risk for Th-232

6.46E-03

Isotope

Produce
Consumption
Risk

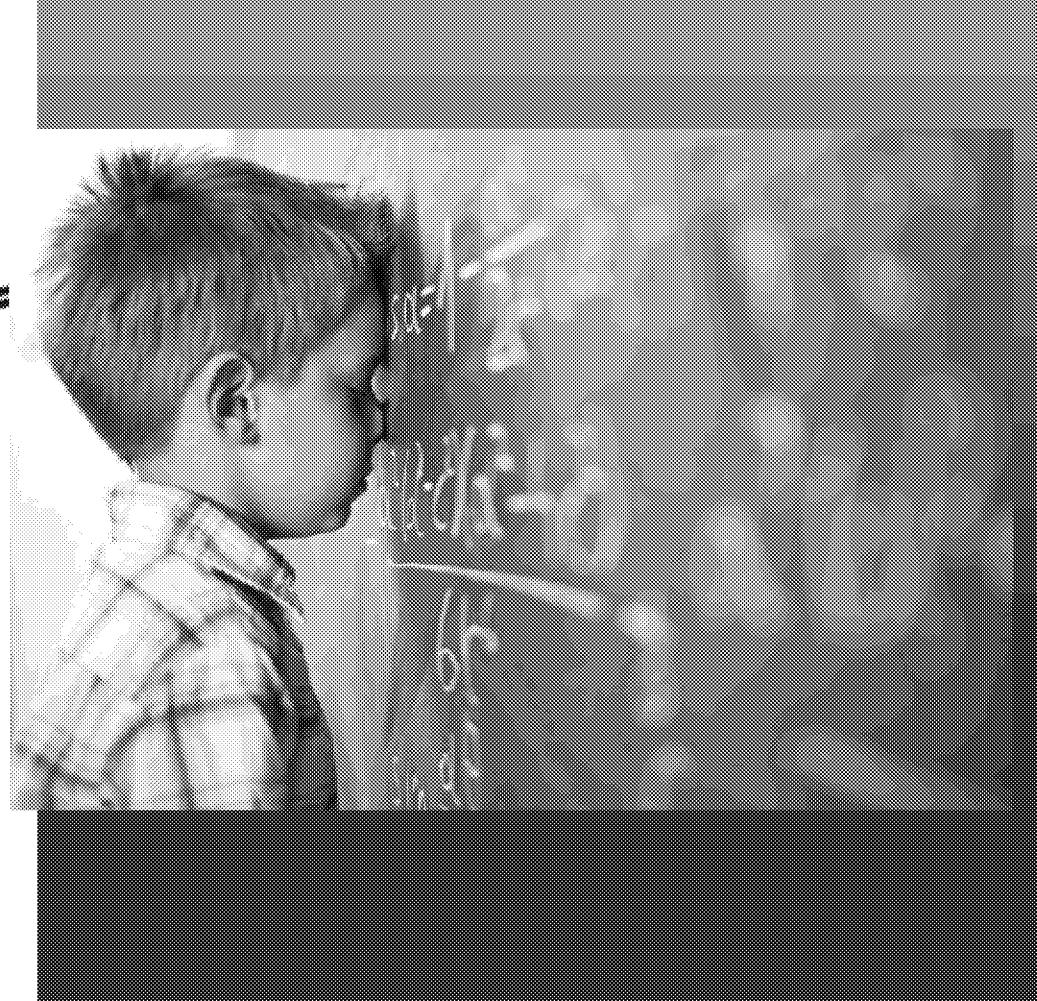
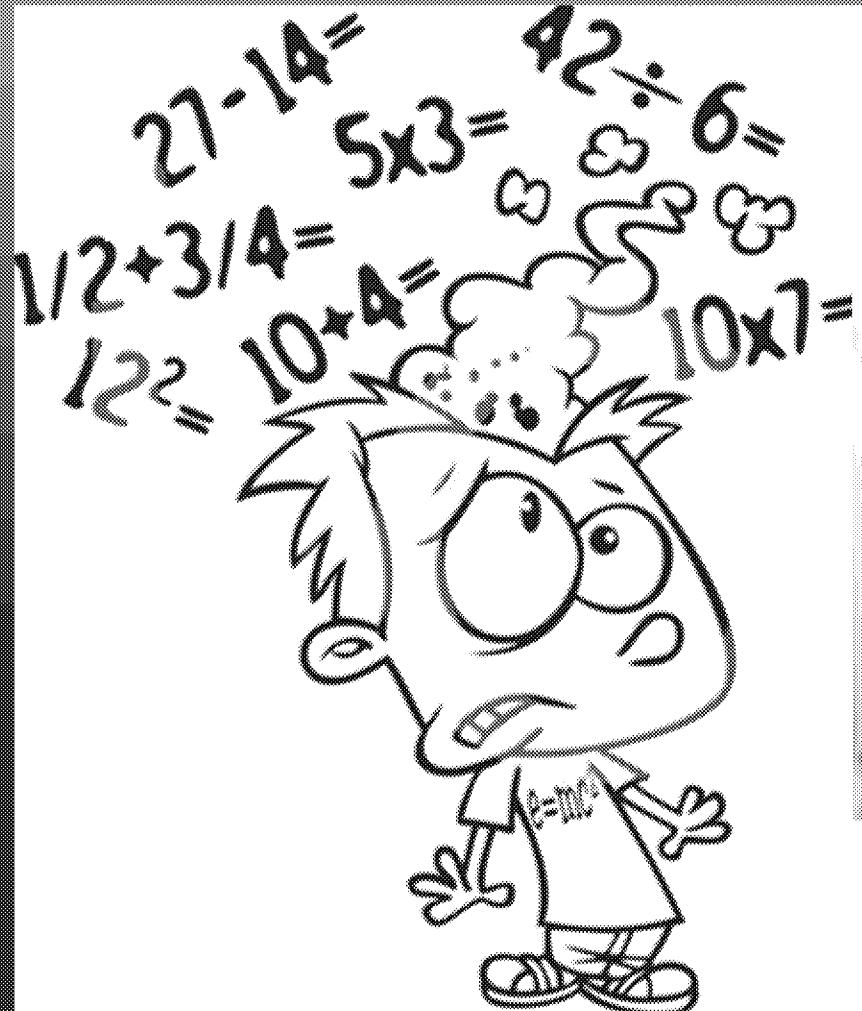
Total
Risk

*Secular Equilibrium Risk for U-238

7.06E-04

The acceptable risk was set to 1.0E-04
(Or you could think of it as 1 in 10,000 excess risk of developing cancer)

Time for some MATH!



738 UMR Risk Output

Isotope	Ingestion Risk	Inhalation Risk	External Exposure Risk	Produce Consumption Risk	Total Risk
*Secular Equilibrium Risk for Th-232	1.10E-03	5.77E-08	5.37E-03	-	6.46E-03

0.0.0.6.46 Greater than 0.0001? Yes!

3 2 1

Isotope	Ingestion Risk	Inhalation Risk	External Exposure Risk	Produce Consumption Risk	Total Risk
*Secular Equilibrium Risk for U-238	2.65E-04	4.08E-09	4.41E-04	-	7.06E-04

7.06E-04 = 0.000706 is greater than 0.0001

The acceptable risk was set to 1.0E-04 = 0.0001
(Or you could think of it as 1 in 10,000 excess risk of developing cancer)

Ok, last slide on Math

LINGO!!!

Typically, we may switch back and forth on terms:

$$1.0E-04 = 1 \times 10^{-4}$$

"E to the minus 4" or "ten to the minus 4"

738 UMR PRG Output

Site-Specific Resident PRGs for Soil - Secular Equilibrium

Isotope	Ingestion PRG TR=0.0001 (pCi/g)	Inhalation PRG TR=0.0001 (pCi/g)	External Exposure PRG TR=0.0001 (pCi/g)	Produce Consumption PRG TR=0.0001 (pCi/g)	Total PRG TR=0.0001 (pCi/g)
*Secular Equilibrium PRG for Th-232	2.95E+01	2.98E+07	6.03E+00	-	5.01E+00
*Secular Equilibrium PRG for U-238	1.38E+01	4.77E+07	8.29E+00	-	5.18E+00

Removal Site Evaluation (RSE)



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION II

DATE: 7/22/14 2014

SUBJECT: Removal Site Evaluation for the 738 Upper Mountain Road Site, Lewiston, New York

FROM: Eric M. Daly, On-Site Coordinator
Response Prevention Branch

TO: Joseph D. Rotola, Chief
Removal Action Branch

Introduction

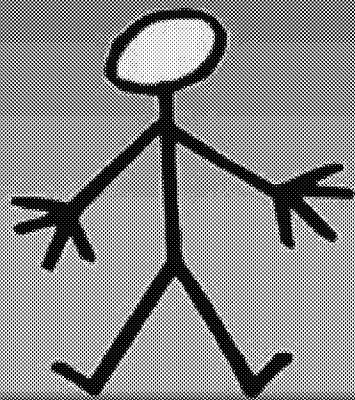
The United States Environmental Protection Agency (EPA) Region II Removal Action Branch (RAB) was requested to conduct a Removal Site Evaluation (RSE) at the 738 Upper Mountain Road Site (Site) by the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH).

In July 1985, members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) performed radiological surveys of properties throughout Niagara County. The results of the surveys were recorded in a November 1986 report, which specifically documented elevated gamma exposure rates at the driveway of the Site, among other sites in Niagara Falls and Lewiston, New York. The NYSDEC and NYSDOH referred 738 Upper Mountain Road to EPA on July 21, 2013 for further assessment.

The EPA Pre-Remedial Section (PRS) screened the Site in December 2013 and as of May 2014 recommended a "No Further Remedial Action Planned" (NFRAP) determination. The NFRAP determination signifies that no additional remedial steps will be taken to list the Site on the National Priorities List (NPL) unless new information warranting further Superfund consideration or conditions not previously known to EPA regarding the Site are disclosed. The NYSDEC and NYSDOH requested RAB to assess the Site for a potential Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) removal action. In response to this, RAB initiated a RSE to determine Site eligibility.

It should be noted that a Removal Site Evaluation, dated 06/12/2018, previously determined that the Site did not warrant a CERCLA removal action. Due to an adjustment and recalculation of the PRO calculator, and the resultant increase in the calculated risk, it was determined that the Site does warrant a CERCLA removal action. This document supersedes the Removal Site Evaluation dated 06/12/2018.

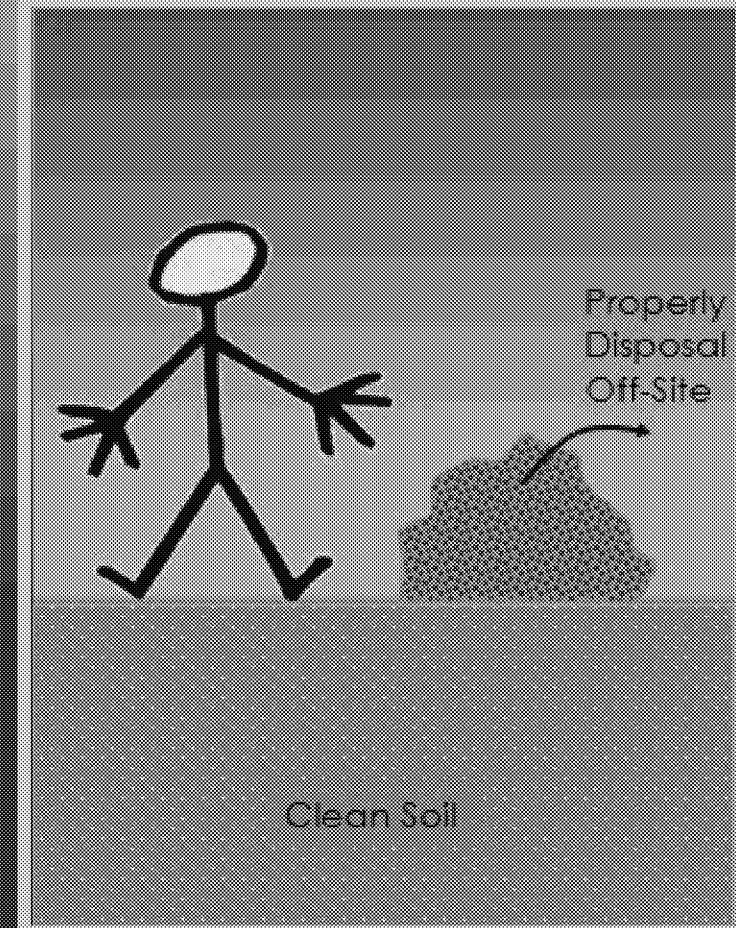
We determined a need for removal... Now what?



The Site as is



Full/Partial
Shielding



Removal

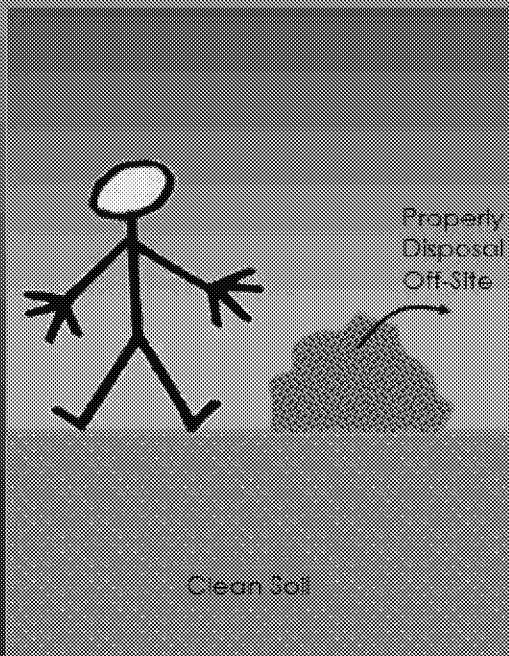
Full Removal

❖ Pros:

- Once the contaminant is removed, the site is CLEAN
- Positive public reception of EPA
- Maybe able to do a combined removal especially with HTC

❖ Cons:

- Need a better picture of the extent of contamination
- Cost
- Time / Interfere with business operations



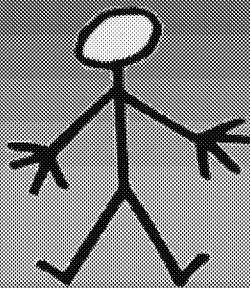
Full/Partial Shielding

❖ Pros:

- Variety of options
- Less time / Cost maybe less depending on material

❖ Cons:

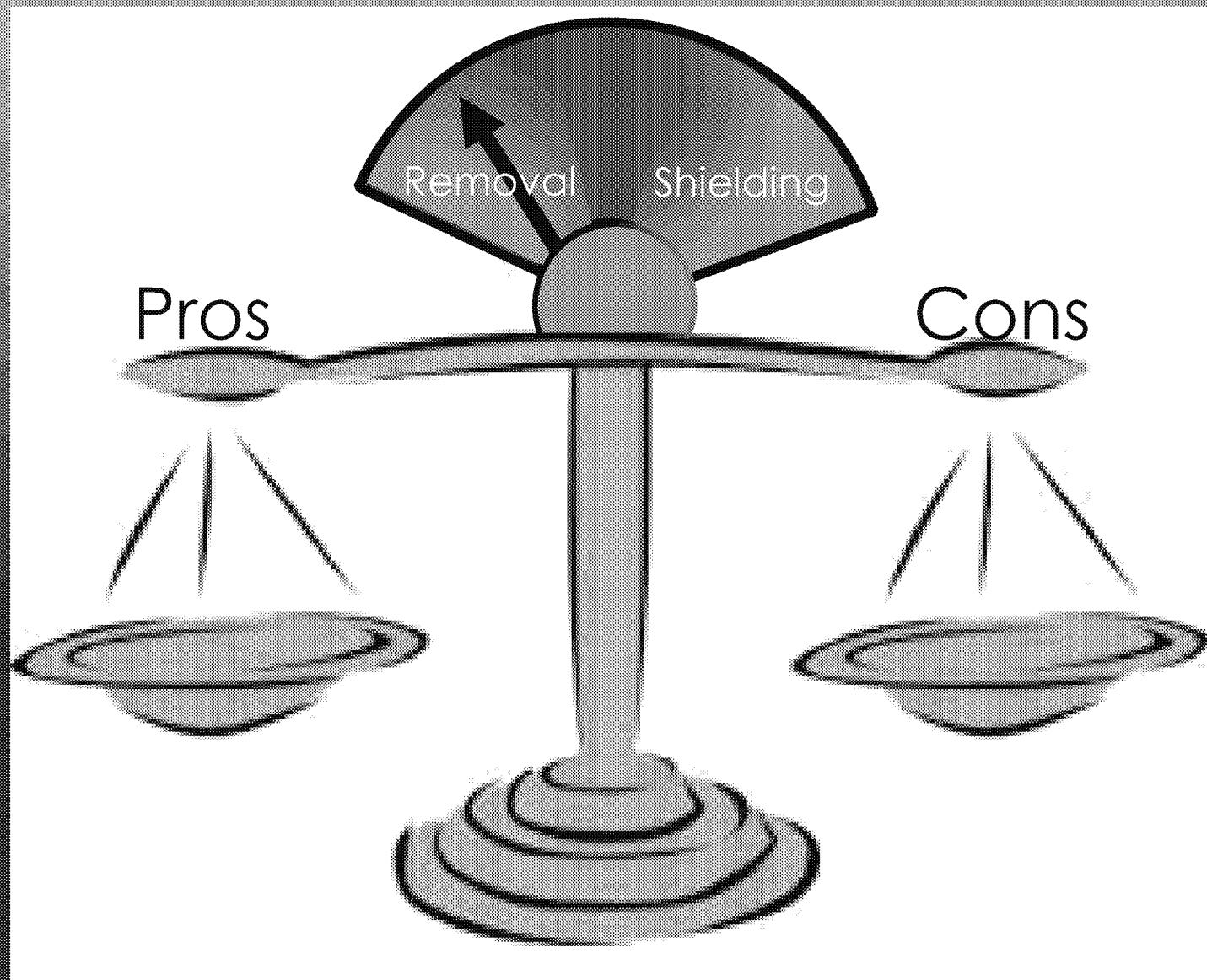
- It's not "cleaned." May be a waste if determined later site doesn't meet remedial goals of 10⁻⁶
- Shielding will need to be maintained
- Will add a height to ground
 - Tripping hazards, installation of ramps or stairs will all need to be considered
 - If you set shielding in ground, contaminated top layer of dirt will need to be removed anyway
- Deed restrictions will be needed
- Negative public perception



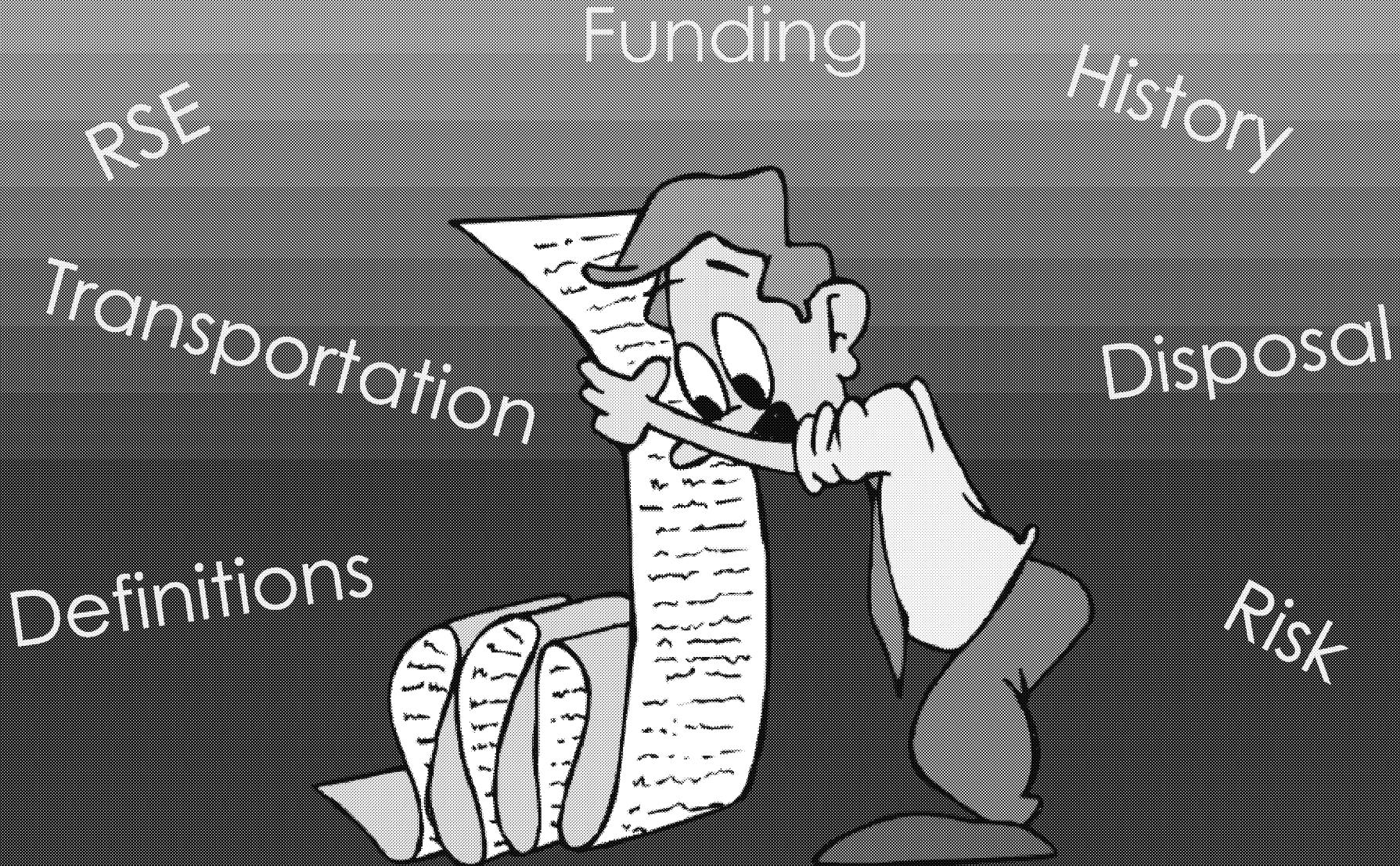
Shielding Material

Clean Soil

Full Removal!!!!



Write our Action Memo

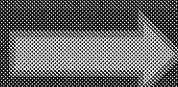


Action Memo Layout

- Basic layout:

- Background of the site
- History
- Terms
- "Threat to Public Health or Welfare" and "Threat to Environment"
- Proposed Action
- Estimated Cost

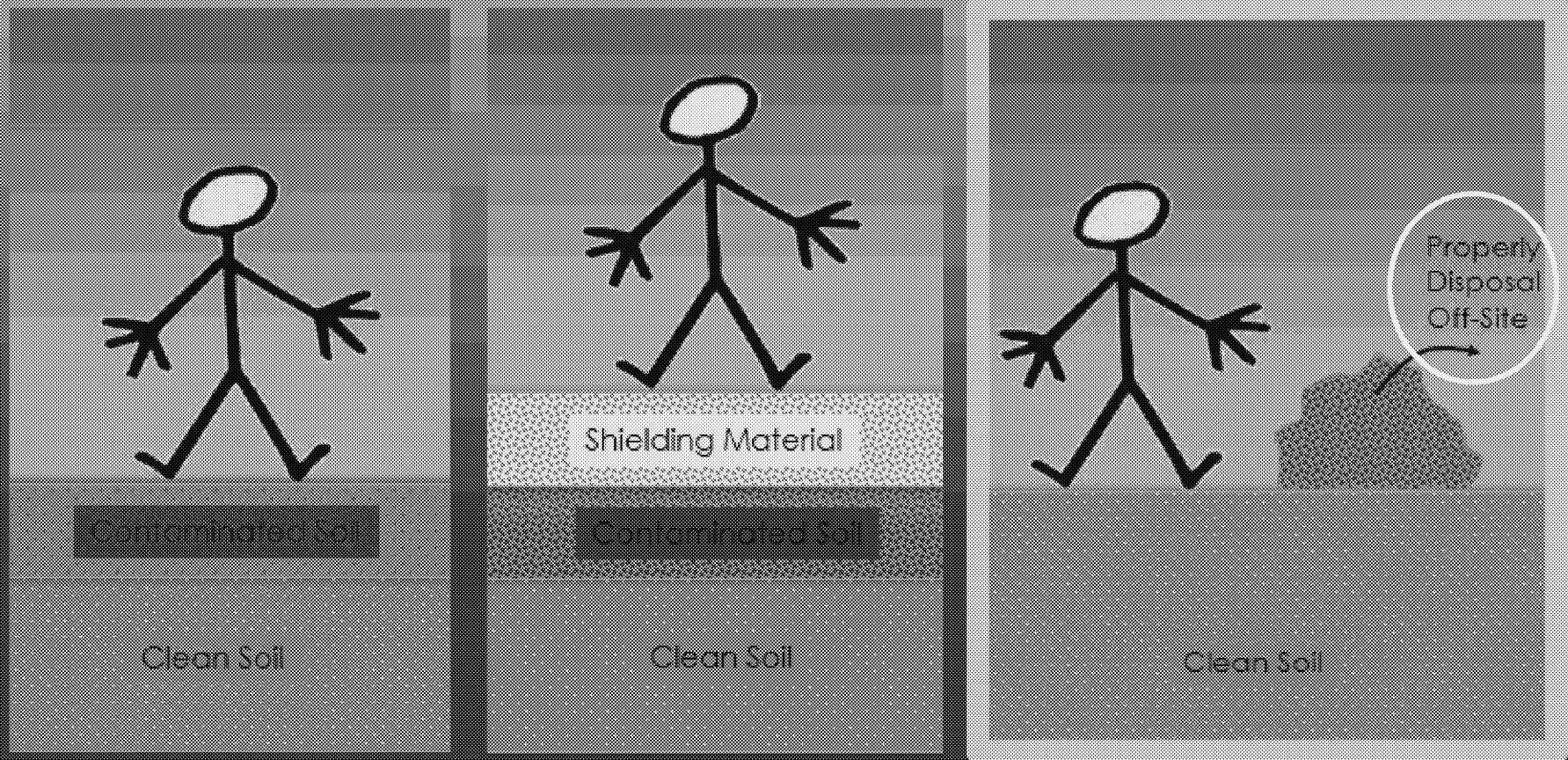
RSE



Proposed Statement of Work

- Establish support facilities on the site property (vehicle parking area, staging areas for equipment, sanitation facilities, and foliage removal);
- Secure and restrict access to the work areas;
- Excavate approximately 102 cubic yards of radioactive material from the identified area of concern on the Site;
- Perform post-excavation gamma surveying, soil sampling, and analysis as per the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) plan;
- Off-Site disposal of hazardous waste and/or substances in compliance with the CERCLA Off-Site Disposal Rule, 40 C.F.R 300.440, and specific disposal acceptance criteria as per the approved radiological disposal facility; and
- Restore excavated area to pre-excavation condition with clean fill.

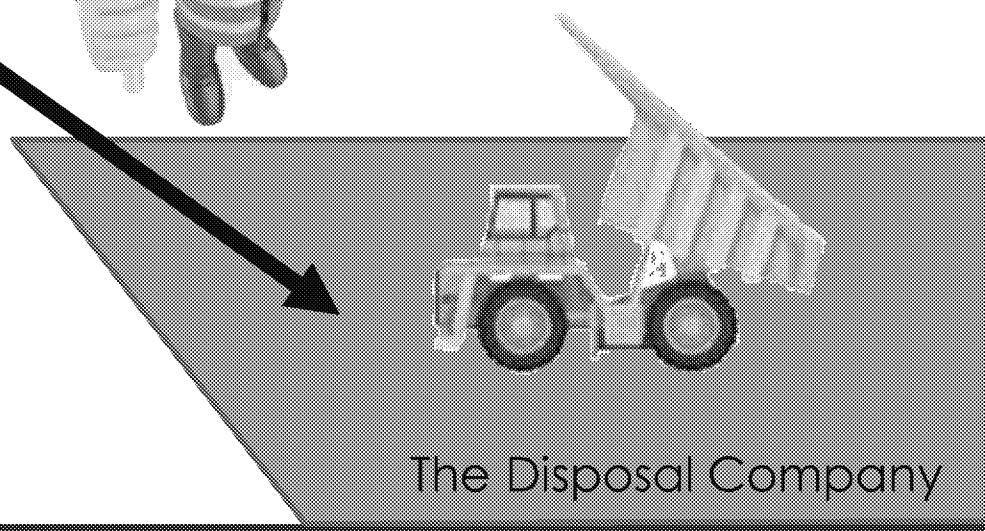
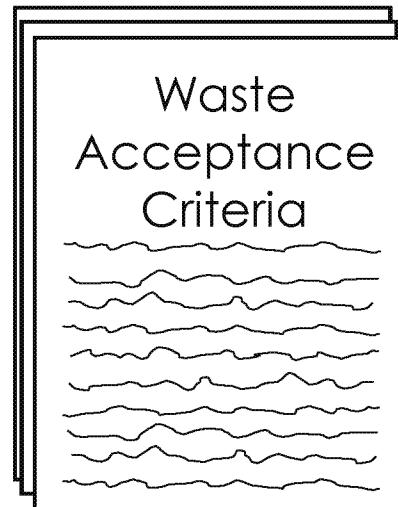
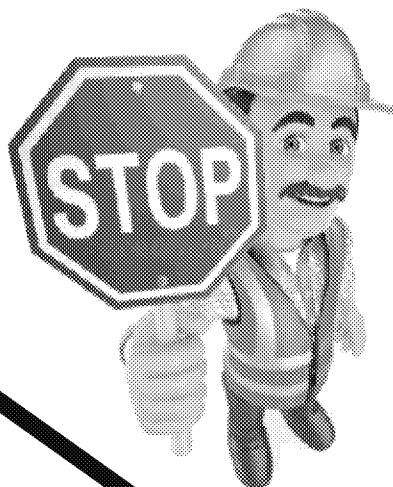
But, how do we do that?



Disposal Operations



The Site: 738 UMR



The Disposal Company

Example WAC

2. Source Material Sum of Fractions (SOF) Formulas:

Natural Uranium + Thorium		Refined Uranium + Thorium		Depleted Uranium + Thorium	
Conc $U-238$	Conc $Th-232$	Conc U -Total	Conc Th -Total	Conc $U-238$	Conc $Th-232$
167 pCi/g	55 pCi/g	$\leq I$	333 pCi/g	110 pCi/g	$\leq I$

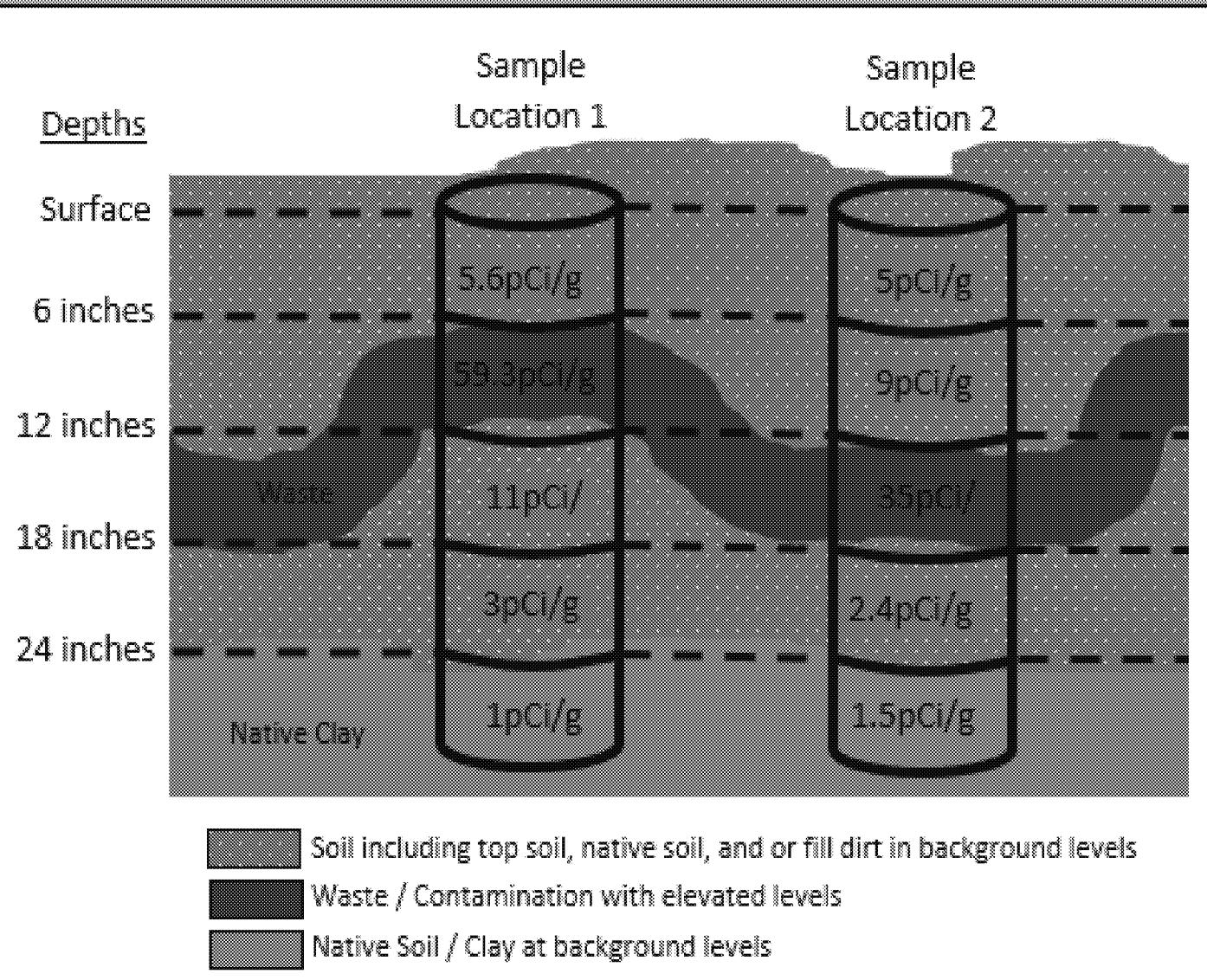
- Notes:
- 1. Unless otherwise noted, use parent nuclide in equations
 - 2. Th-232 will routinely be considered to be in equilibrium with all progeny.
 - 3. Total Uranium = $U-234 + U-235 + U-238$.
 - 4. Total Thorium = $Th-232 + Th-228$
 - 5. Refined Uranium refers to chemical forms where the equilibrium state of the uranium decay chain has been disrupted.
 - 6. Depleted Uranium contains $U-235$ at < 0.71% by weight

D. NORM/TENORM other than Source Material Dispersed in Soil or Other Media

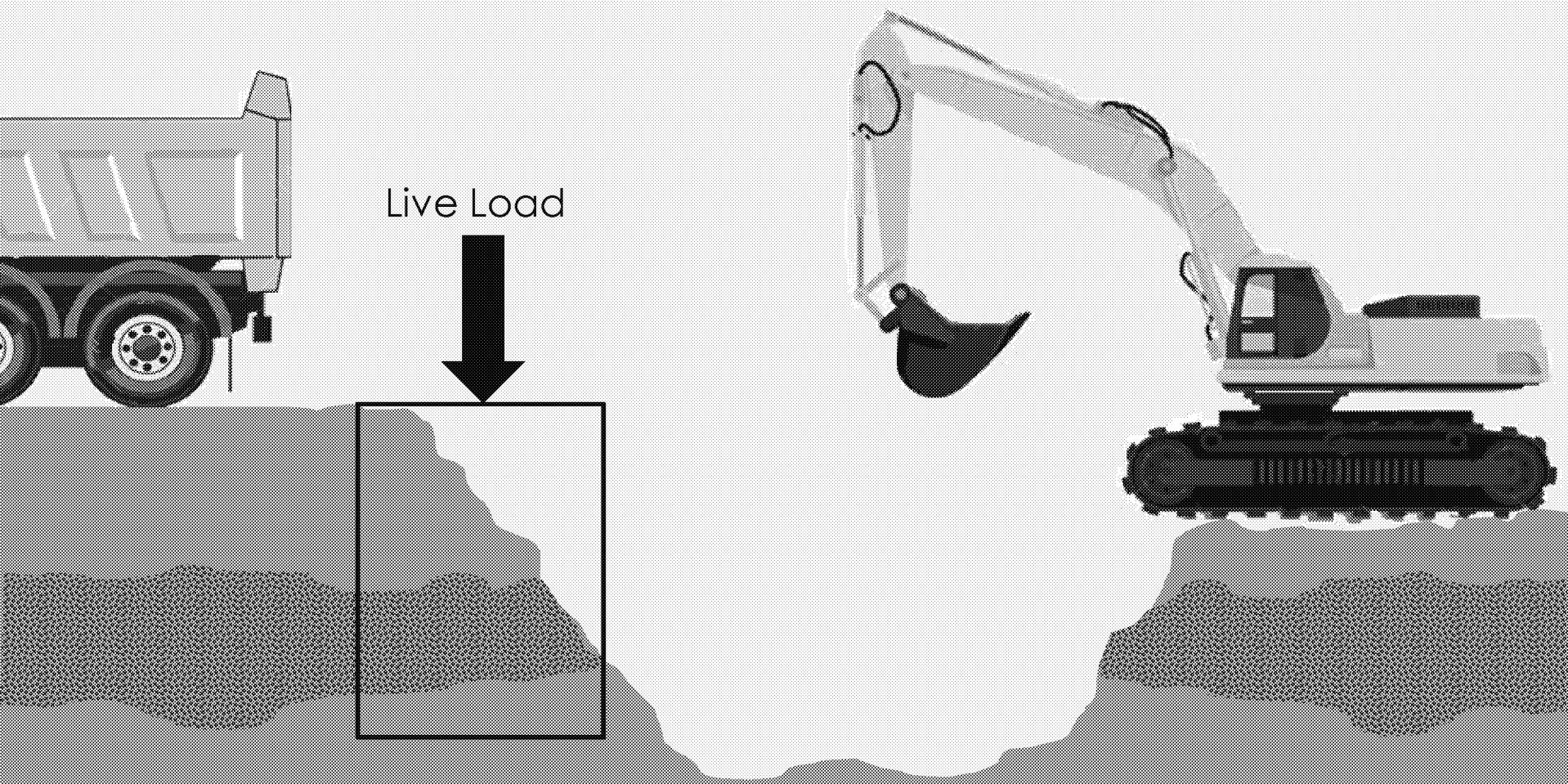
1. Does the waste contain:	<input checked="" type="checkbox"/> Ra-226	<input type="checkbox"/> Pb-210	<input type="checkbox"/> K-40	<input type="checkbox"/> Other(s)
2. Waste Concentration (pCi/g):	46	N/A	N/A	N/A
3. WDI Site Disposal Limits: (Note 1)	50	260	(Note 2)	(Note 3)

- Notes:
- 1. MDI may receive higher concentrations for treatment or blending. All treated waste intended for disposal at WDI must meet the limits shown in D.3.
 - 2. K-40 may not be enriched beyond its natural concentration.
 - 3. Contact WDI Waste Approvals.

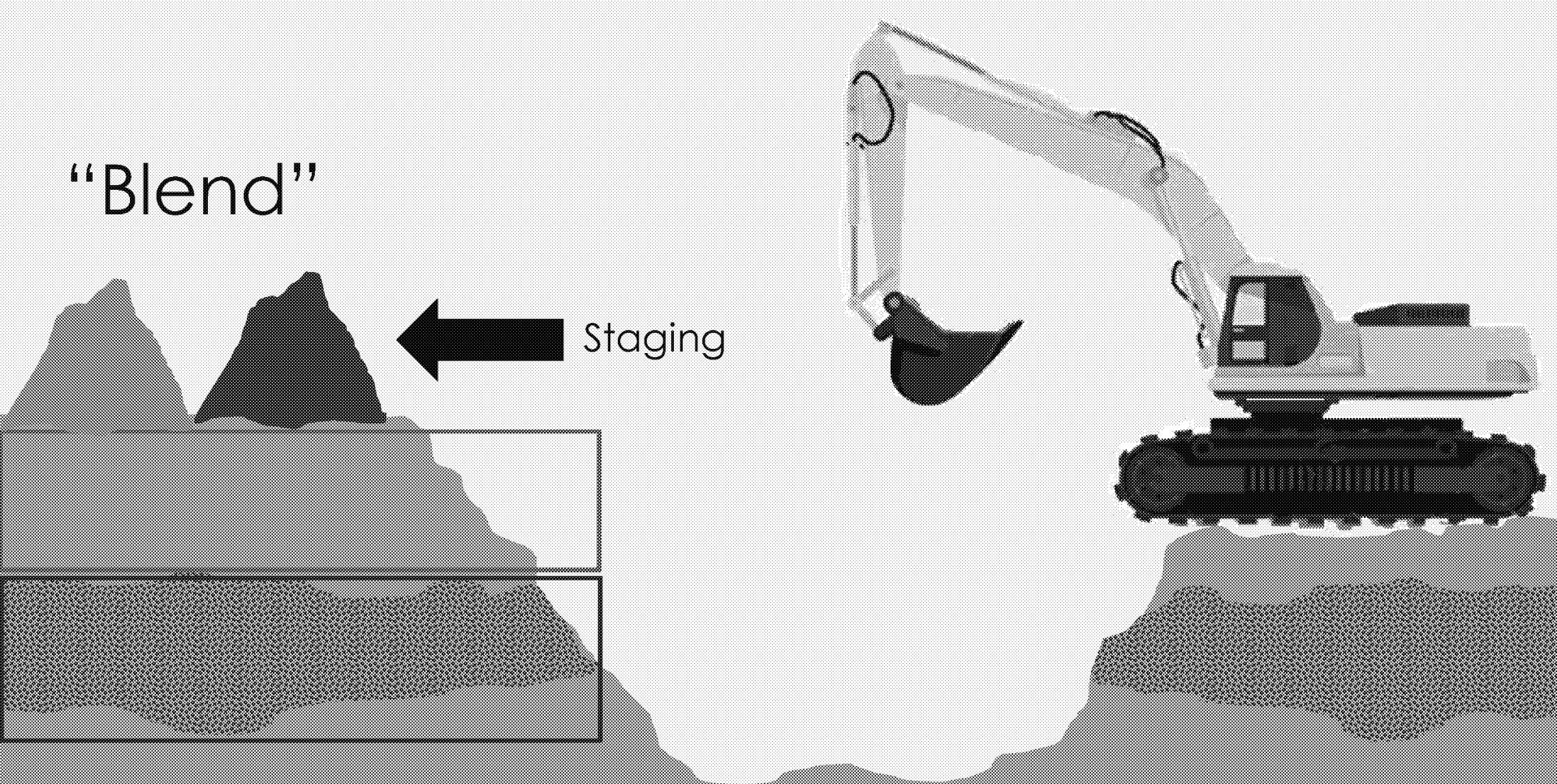
Meeting the WAC



Live Loading vs. Staging



Live Loading vs. Staging



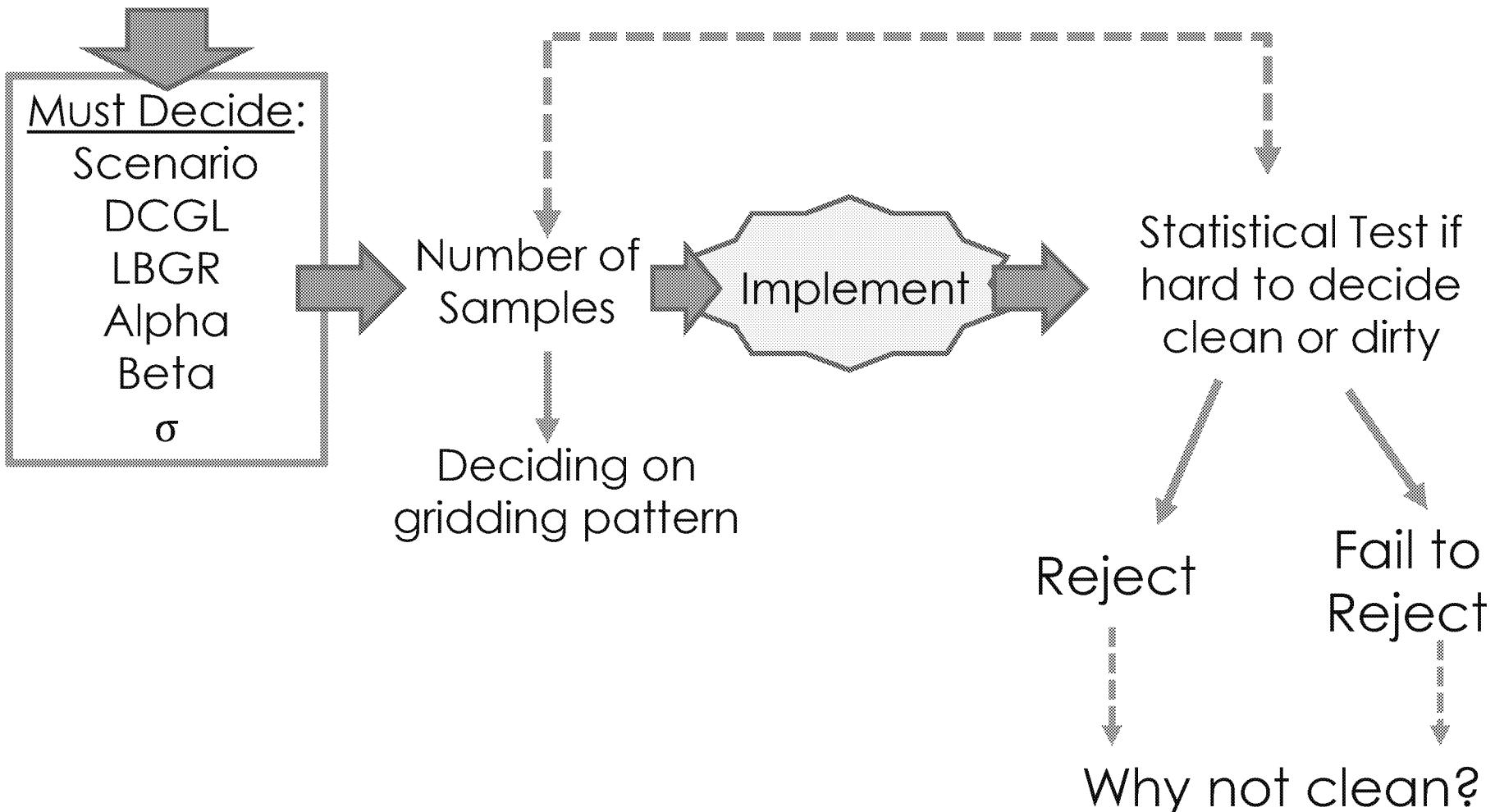
Major concern to consider: Logistics

Process for determining clean / Post-Disposal

- ✿ How do we determine if site is clean?
- ✿ Go down to native (background)
- ✿ Gamma surveys
- ✿ Post excavation sampling
- ✿ Backfill with clean material—sampled
- ✿ Analytical
- ✿ MARSSIM process to determine if clean
- ✿ If not, area will be re-excavated

MARSSIM

Based on
Previous Data



Work this Week: Additional Sample Location



Work this Week: Property Boundary



Any Questions?